19. Discuss the importance of waveguides in electromagnetic wave propagation and their applications.

20. Elaborate the significance of magneto-hydrodynamics in understanding plasma behavior.

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NOVEMBER/DECEMBER 2025

23PPH23 — ELECTROMAGNETIC THEORY

Time : Three hours Maximum : 75 marks

SECTION A — (10 × 2 = 20 marks)

Answer ALL questions.

1. Tell the concept of molecular polarizability.

2. Outline the multipole expansion.

3. Find the concept of magnetostatic energy.

4. Summarize the boundary conditions in magnetostatics?

5. Give the role of vector and scalar potentials in electromagnetism.

6. Write the Poynting's theorem.

7. List the concept of plane waves in non-conducting media.

8. Illustrate the inhomogeneous wave equation.

9. Define the role of oscillating electric dipoles in radiation.

10. Write the simplified magneto-hydrodynamic equation.

SECTION B — (5 × 5 = 25 marks)

Answer ALL questions.

11. (a) Discuss the application of the uniqueness theorem in electrostatic problems.

Or

(b) Elaborate the role of multipole expansion in calculating electrostatic potentials.

12. (a) Write the importance of the magnetic moment in external magnetic fields.

Or

(b) Give the application of the Biot-Savart law in practical scenarios.

13. (a) Explain the Lorentz force in electromagnetic theory.

Or

(b) Give the application of Poynting's theorem in energy conservation.

14. (a) Discuss the terms of reflection and refraction at a plane interface.

Or

(b) List out the applications of circular polarization in practical scenarios.

15. (a) Discuss about the oscillating electric dipoles in radiation theory.

Or

(b) Write the application of simplified magneto-hydrodynamic equations in practical scenarios.

SECTION C — (3 × 10 = 30 marks)

Answer any THREE questions.

16. Discuss about the electrostatic energy in the presence of a dielectric and its implications.

17. Give detailed explanation of how magnetostatic energy is calculated and its implications?

18. Explain the significance of gauge invariance in electromagnetic theory.